

OBJECTIVE STUDIE UBER DIE TRANSFUSION DES BLUTES UND DEREN VERWERTHBARKEIT AUF DEM SCHLACHTFELDE

BY: Dr JOSEF FRIEDRICH ECKERT (1876)

A TRANSLATION PAGES 1-27 BY PHIL LEAROYD

The book 'Objective study on the transfusion of blood and its usability on the battlefield' by Joseph Friedrich Eckhart was published in 1876 in Vienna [by Moritz Perles]. A copy of this 168 page book can be viewed or downloaded from the following sites:

<https://wellcomecollection.org/works/asxbmx32>

https://books.google.co.uk/books/about/Objective_Studie_%C3%BCber_die_Transfusion_d.html?id=nNA1AQAAMAAJ&redir_esc=y

There is no index at the start of this book but there is a contents list on the last three (unnumbered) pages at the end of the book, which identify the following chapters:

CHAPTER	TITLE	PAGE
1	Historical Introduction	1
2	Transfusion with defibrinated blood	19
3	Casuistry of defibrinated blood	28
4	Observations on the entry of air into blood vessels	46
5	Reasons against defibrinating blood	50
6	Intermediate venous-arterial transfusion	63
7	Animal blood transfusion in humans	67
8	The technique of animal blood transfusions	76
9	How much blood should we transfer?	84
10	Casuistry of animal blood transfusions	87
11	Comments on the use of lambs	113
12	Immediate transfusion with venous lamb blood	114
13	Immediate transfusion with venous human blood	117
14	Indications	131
15	Corollary	136
16	The usability of transfusion in the battlefield	157

I have translated the first two chapters of this book from the original German into English in the hope that the content may be appreciated by a wider audience. I have included the second chapter in the translation as it contains some important historical information regarding the development and increasing use of defibrinated blood in Germany and provides an illustration of the improving knowledge of the role of red cells and that of blood transfusion itself. Whilst I am obviously aware that instantaneous computer-generated translation is possible, this process struggles with specialist terminology and also produces a 'colloquial style' not always representative of the original text. Whilst some of the words / terms originally used by Eckert are obviously open to interpretation, I have attempted wherever possible to hopefully maintain the author's meaning, intent and detail, so as to make the translation as 'un-interpreted' as possible. As with any translation the wording may be purposely or inadvertently altered in an attempt to 'make it read better' but in doing so there has to be an element of personal interpretation involving something on the lines of 'I think

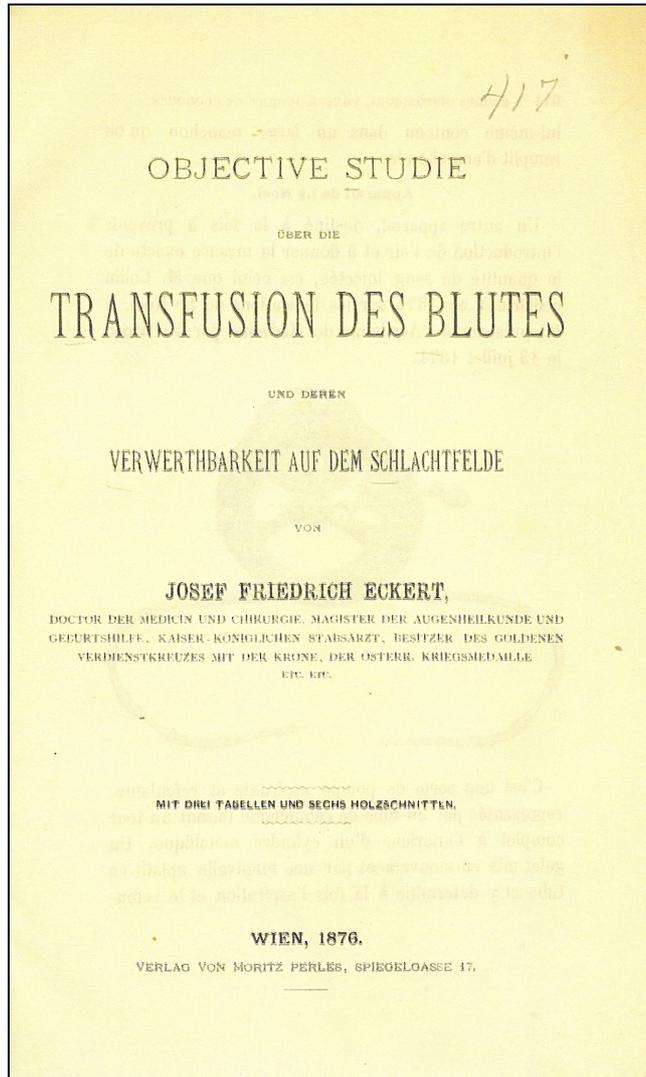
that this is what the author is actually trying to say'. I wanted to avoid that as much as possible and try to present what the author actually wrote and as a result the reader may find that the English text does not 'flow' as well as it could. Although I have taken great care not to misrepresent the author's original wording I cannot guarantee that this work does not contain 'translational errors' and the reader is recommended to check specific details against the original German text.

I have included Eckert's actual spelling of the names of people and places as they appear in the book and I have also reproduced the original paragraph settings. There are some references within the actual text but somewhat confusingly the book also contains three sections of 'references' that relate to three different time periods, i.e. pages 17-19 inclusive cover the period 1815-1839, pages 59-63 inclusive cover the period 1840-1868 and pages 141-144 inclusive cover the period 1869-1875. I have been able to include all three sections at the end of this translation as none of the 'references' actually relate to the text itself. As such they appear to have been selected by the author purely on 'personal preference' as a type of bibliography rather than to add confirmation to individual comments within the text or allow the reader to investigate a particular subject in more detail. These references are presented as written by the author.

The first chapter 'Historical Introduction' briefly covers the time prior to the discovery of the circulation and then provides additional information about the history of transfusion in what frequently reads as a series of somewhat disparate pieces of information, certainly not all of which are important historical developmental steps in the history of transfusion; in fact some lack any significance whatsoever and appear to have been included solely because the author came across them in his research for the book. As such, whilst this chapter contains interesting information, especially as would be expected regarding aspects of experimental research work carried out in Germany and the Austro-Hungarian Empire, it does at times read somewhat disjointedly. It is interesting to note that Eckert consistently refers to 'blood transfer' or 'blood conduction' (i.e. Blutüberleitung) in this chapter rather than to 'blood transfusion'.

The second chapter 'Transfusion with defibrinated blood' starts with what amounts to a lengthy eulogy on Muller himself before the author describes Muller's work on identifying the oxygen carrying capacity of red cells and therefore providing an explanation why defibrinated blood can be used for transfusion without 'depleting' its functionality. In fact, due to the work of both Muller and Dieffenbach being so prominent in Germany is the reason why Eckert is able to differentiate the content of Chapters 1 and 2. This chapter also includes a description of the defibrinated blood transfusion method used by Oscar Hasse, which also relates to the one page of diagrams that appears at the end of the book (on an un-numbered page). This page of figures is included at the end of the translation of Chapter 2.

The page of figures also includes Eckert's further development of Franz Gesellius' idea of using lamb's blood for transfusing to injured soldiers on a battlefield – this involved the use of a harness arrangement for transporting a lamb in a harness on the back of a medical assistant so it could be carried onto a battlefield and used for direct blood transfusions. This is illustrated within this diagrams page and relates to information provided in Chapter 16, 'The usability of transfusion in the battlefield' that rather goes against what is postulated in Chapter 2 of this book, which is the preferred use of defibrinated human blood by an indirect transfusion technique. [Gesellius was a strong opponent of the use of defibrinated blood.] The inclusion of this material obviously relates to the title but may well have been influenced by the fact that Eckert is listed as being 'Medical Officer Dr. Eckert' at the beginning of the book – he was in fact an Austrian Military Surgeon – and that the book is dedicated to 'His Royal Highness, the Lord, Imperial Royal Field Marshal-Lieutenant Wilhelm Herzog von Wurtemberg'.



Title page of 'Objective study about the transfusion of blood and their usability on the battlefield' by Joseph Friedrich Eckhart (1876) (Image credit: Wellcome Collection)

1. HISTORICAL INTRODUCTION

Ovid was the first to express in his *Metamorphoses*, especially in *Medea*, the poetic foreboding idea: to shed the old blood and to fill the empty veins with youthful juices. In the seventh book we read:

Quid nunc dubitatis inertes?
Stringite gladios veteremque haurite cruorem
Ut repleam vacuas juvenili sanguinis venas!

Raynaldus relates: That Pope Innocent VIII suffered from a serious illness for two years and often lay unconscious for 20 hours without any signs of life. When all art was in vain, a fraudulent Jew promised to produce it. He withdrew the blood from 13-year-old boys and used it to prepare a healing potion for the Pope through the infernal art of cutting. The boys died; when Innocent awoke, he ordered the damned criminal Jew to be killed, but he quickly evaded punishment by fleeing.

Sismondi and Villari however, relate this story quite differently; Pope Innocent VIII fell into such weakness and drowsiness that one generally expected his death. An Israelite doctor suggested that the Pope have a transfusion to be done with a new apparatus which has already been tried out on animals. The blood of three boys was now passed into the blood of the Pope and the blood of Innocent VIII was passed into the blood of the boys. But the three boys died and the Pope could not be saved, he too died on 25 April 1492.

Other French writers of that period cite the same thing, only in one case we find the remark that the three boys died by air leaking into their blood vessels and that the surgeon fled out of fear; no success was achieved. The most credible notes are the: "Histoire des République italiennes du moyjen âge", Paris 1815, taken from Simonde de Sismondi,

Magnus Pegelius, Professor of Rostock, born in 1547, first published the idea of transfusion in his work "Thesaurus rerum selectarum" in 1604. Andreas Libavius, Doctor of Medicine and Director at the Gymnasium in Coburg, was an opponent of the idea, and in a sharply drawn satire attacked it and tried to ridicule the views of M. Pegelius in his writings.

When listing the foods and the alchemical healing bodies through which one could prolong life, Colle, Professor at Padua, mentions in 1628: One can live life by drawing blood by means of a tube which leads it from a perfectly healthy youth to an old man - much easier to lengthen than by medicine.

Robert Boyle's writings, 1667, deal with transfusion in many ways and describe the first successful experiment by Lower and King, which they carried out on the Baccalaureate Coga. The anthology "Philosophical Transaction" from 1665 to 1667 indicates the first beginnings of transfusion in England and France and lists the attempts of Boyle, Coxe, Clarke, Henshaw, Hook, King and Lower.

Louis de Baril, Claude Tardy, J. Denis, G. Lamy and C. Gaudrois repeatedly speak of the transfusion in their works in 1667.

Pierre Martin de la Martiniere and Eutyphronis appear in 1668 as opponents of this operation.

J. Major, Professor of Medicine in Kiel, modestly named himself the first inventor of the transfusion in a brochure in 1667, which he called the 'new transplantation', to distinguish it from the 'sympathetic transmission of diseases', which was generally believed at that time. His method was of course an extremely primitive one, first the blood giver and then the blood recipient were properly purged; Major made use of an 18 centimetre-long 140-gram silver tube, one end of which was curved and thinly pointed, the other resembled a cup. The curved end was placed in the blood vessel of the blood recipient who was previously given a 140 gram bleed. A bandage was placed below the wound to prevent further blood loss. Now a superficial blood vein

of a healthy, full-blooded person was opened and the cupping head-like end of the tube was firmly attached so that the blood had to flow in without being decomposed by the outside air. If the surgeon believed that the tube was already filled with blood, he inserted a suitable matching stamp and pressed the blood into the vein of the blood recipient as if with a syringe. In order to prevent the blood from coagulating, Major advised holding glowing coals to the tube and to earlier throw in some ammonia spirit or volatile stag-horn salt into it.

The Swedish Countess N., one of Major's patients, generously presented him with a ring with fake diamonds; the professor is said to have got into a terrible rage about this, so that he died in Sweden in 1693.

A pamphlet by J. H. Glaverius: "Ortus et progressus clysmatae novae" claimed some interest in 1667.

After Denis and Emmerez had already carried out many animal blood transfusions in 1674 with favourable results, the former carried out a blood transfer to Paris in 1667 on humans with good results. In the same year Lower and King followed him repeatedly in England with very good success.

But nonsensical ideas soon followed this discovery, and it was believed that a means of rejuvenation had been found. The opponents attributed this invention to the devil and caused it to be subject to ecclesiastical and secular bans!

Denis' transfusions in 1668 brought about a revolution in medicine, and divided French physicians into two fiercely opposed parties. Gadrois, Bourdelot, Louis de Baril, Gaspard de Gurye, Sieur de Montpolly, Montmor, and the Professor of Surgery Claud Tardy, were Denis' most ardent followers and the most ardent defenders of transfusion. The majority of the jealous doctors of the Paris Faculty, Lamy and Martin de la Martiniér, were the fiercest opponents who showered the transfusion with lies, slander and shame! In spite of this, Denis rose to high popularity among the Parisians and became a personal royal physician; from then on, however, his zeal grew cold, tired of the long quarrel, he left the transfusion to its fate, which then fell into complete discredit.

Irenäus Vehr expressed some highly original things in his dissertation published in Frankfurt in 1668. The transfusion should only be carried out on people who are not frightened by the sight of the blood. Artery blood is more excellent, nevertheless one should only inject from vein to vein, since injuring the arteries is associated with too much danger. Vehr was a fierce opponent of animal blood transfusions and tells a wonderful story of how a girl obtained a perfect cat nature from drinking cat blood. In the most urgent emergency, blood should be taken from the image of meekness, from the lamb.

In 1668 the Dutchman Joh. van Horne carried out the transfusion on animals with luck and ease in the presence of many spectators. Ludwig de Bils was described by his compatriots Tobias Andreae and Regner de Graaf as the inventor of the transfusion; for his numerous animal transfusions the latter used two duck-bones pushed into one another.

Bartholomew Santinelli was one of the fiercest opponents of transfusion and made it highly suspicious with his diatribe "Confusio transfusionis" 1668. Since the books of Moses forbid the internal use of blood, since transfusion is therefore against the commandments of God, so it was strictly forbidden by the secular authorities for reasons of religion

In 1668, in Rome, Paul Manfred [Manfredi] published his "new and outrageous surgical operation, by which the blood is transferred from one person to another, etc." This little document contains his transfusion of a febrile carpenter and a description of three transfusions by Riva.

Domenicus Cassini was the first Italian to perform a transfusion from the carotid artery of one lamb into the jugular blood vessel of a second lamb on 28 May 1667 in Bologna. He let as much blood as possible drain from the latter, the lamb only perished after 6 months. These notes are taken from A. Tinassis's reports from

1668, in which he also includes the following highly interesting transfusion: Tinassi and the surgeon Carassini made a transfusion on a 13-year-old, medium-sized dog in the house of Griffonis on 20 May 1668. He had already been completely deaf for three years, could hardly walk and dragged his feet behind him, which he could not lift because of weakness. The whole blood of a lamb was transfused into this dead dog. The dog lay quietly for an hour after the operation, then he jumped up, looked for his master, who was in another room, and after two days he left the house and ran around with the rest of the dogs, what he had not been able to do for three years. The appetite had increased significantly, the feet were no longer dragged along and the hearing had improved so significantly that he heard his master's whistle again and followed it.

Ippolito Magnani came to the conviction through his experiments in Rome from 1667–1668 that one had to transfer over foreign blood in moderate amounts.

The Brandenburg personal physician Sigmund Elsholz, who wrote in 1665–1667 and 1668 about the injection of medicinal products, was a warm defender of transfusion. He found it easier to do it with a syringe, but cheaper to use a tube because it changes the blood less. Both animal and human blood can strengthen the anaemic and the weak, and soften hot blood. Elsholz believed in the power of sympathy and stated that one could transfer diseases from a person to an animal through transfusion, as well as that one could reconcile hostile brothers or disunited spouses through a mutual transfusion.

Richard Lower, who first transfused a dog in 1666, published his further experiments at Oxford in 1669 in his treatise on the heart.

After Boyle and Wilkins had drawn attention to the transfer of blood in dogs and Dr Allen refused to allow a transfusion intended by the Royal Society of Physicians in London at the Bedlam insane asylum, the famous anatomist Lower made the announcement that the theology Baccalaureate Arthur Coga was ready to have the experiment carried out on him for the price of a guinea. The request was accepted, Lower and King asked to carry out the experiment, and the same thing was carried out on Saturday, 23 November 1667, at 10 o'clock in the morning in Arundel House. At the meeting on December 5th of the same year King read out the report on this transfusion: After the carotid of a young sheep had been properly prepared, the blood was first passed through a silver tube into a vessel in order to determine the amount. About 420 grams flowed out during one minute. The blood vessel of the Baccalaureate was then prepared and 245 grams of blood withdrawn from it, then a silver tube was connected by means of a feather float [quill]. The amount of blood transferred was 350 grams. The theologian, who rented himself for the experiment, was perfectly well both during and after the operation and asked to do the same on him again after 2-3 days. Coga himself described the whole process in Latin. The second attempt took place on 12 December 1667, 180 grams of blood were withdrawn and 490 grams of sheep's blood was transferred. According to King's report in the Royal Society of 9 January 1668, the blood recipient felt quite well again both during and after the operation, during which there was an enormous influx of spectators. Immediately after the transfusion, Coga ingested a tremendous quantity of wine, and after an hour there was great excitement.

It is true that these two experiments were carried out in a very perfect manner, and the Royal Society can only be said to have the upmost praise for their interest in and zeal for scientific experimentation.

Soon afterwards Querin and Croon tried to connect the arteries and blood vessels of two animals, in such a way to create a circuit, in order to find out whether, if one animal were fed, this would suffice for the nourishment of both. Encouraged by favourable results, the governors of the hospitals were asked to choose suitable patients for these experiments, and it seemed that they wanted to carry out these experiments on a grand scale. Then the terrible news came to England that doctors who had carried out the transfusion had been prosecuted in Paris, convictions and

incarceration had taken place. This had a discouraging effect on London; not only were the experiments abandoned, but a full century had to pass before one regained the courage to deal seriously with blood transfer.

Lower's apparatus was described by Scultet in 1672.

Heinrich Kruger from Luneburg, who preferred the injection of medicines to blood and warned against animal blood transfusions in humans, announced in 1670 that he would defend indiscriminate attacks on his views and his person with the help of the police.

Claude Gerrault and Abraham Merklin were enemies of transfusion, the latter pronounced in 1674 that the doctor had nothing to do with transfusions from one animal to another, that transfusions from animals to humans and those from one person to another should be discarded entirely, although they did not give rise to any fear of malignant change, they would still have to be justified further.

According to Franz Klein, Professor in Wurzburg, and then by Vehr and Merklin, Moriz Hoffmann, Professor in Altorf, is said to be the inventor of transfusion. In 1662 Hoffmann tried to introduce only a few drops, by no means large quantities, from a blood vein in the back of the hand of a healthy person into the hand vein of a patient by means of a short tube; this little blood should suffice to change the whole amount of blood as if by a new ferment, especially if one chooses different kinds of blood quality; Hoffmann considered these few drops to be sufficient to cure diseases of the body and mind.

The German doctor Philippi was an eyewitness to the brilliant transfusions from Denis in Paris, especially those on the decrepit old horse that had been rejuvenated by blood transfer, the one on a strap carrier and a sleepy servant. His communications encouraged Cornel Honn to conduct numerous physiological experiments in 1676, which led him to the following conclusions: In the event of severe blood loss, transfusion must be used, human blood is more excellent than animal blood, but the latter is by no means to be despised. The transfer of healthy blood could, if not cure, could at least significantly improve different disease states. One animal could live quite well with the blood of a second animal. The state of strength of old and declining people can be significantly improved through new blood, but not rejuvenated. Transfusion should only be used in very severe illnesses in which one has already tried in vain to improve the juices with medicines, and the internal organs should be healthy. Many experiments on malefactors and animals are still necessary in order to gain some certainty. Honn thought that it was a fairy tale that disunited spouses could be reconciled through a reciprocal transfusion.

As an example of a bombastic, exaggerated title, we cite the following: *Francisci Kleinii sanguinea a pollinea e pola estrae acies, quam sine strage coecis visum, surdis auditum, deliris mentem, vetulis juventutem, uxoribus pacem restituendo, instruxit auctor, dum dominum J. V. Helmuth medecina e doctorem crearet.* *Herbipol.* 1680.

Despite its pompous title, the content of this dissertation was extremely poor. Since Aristotle claimed that an old man with the eye of a young man also sees like a young man, the blood of a young man must revive an old man and make him bold. The change of mind through the transfusion is possible.

Francesco Follio, a doctor and natural scientist who was highly respected in Florence in 1680, gave the following method of carrying out the transfusion: A small funnel of bone, which has an incision, is placed on the opened vein of the blood donor, which should not be pressed. An intestine or a bladder is tied to it, to which a fine silver tube is attached. Instead of the intestine, one could use a prepared artery which has a small branch through which the air can escape. The main thing is to take care that no air gets in. Through this apparatus the blood of the healthy person is now conducted into the blood vessel of the patient; the blood flows over of its own accord, without the need to apply pressure. The silver tube can be left in the

patient's vein if it does not cause pain, in order to save having to insert it a second time.

Michael Ettenmuller proved in a dissertation in Leipzig in 1682 that every transfusion is associated with mortal danger because of the peculiar differences in blood. Only small amounts of blood have to be passed over at once; Lower's tubes, which caused blood to clot because of their excessive length, he rejected and preferred those of Denis, whose experiments he attended in Paris. Transfusion should be used against violent blood flows and certain kinds of mania and melancholy, against diseases of the fixed parts, against exhaustion from diseases, and against old age, transfusion could do nothing at all. It should not occur to anyone to try to cure scurvy, palpitations, hypochondria, and fever with the same, at most the transfusion could be used in desperate cases against diseases of liquid parts.

In 1693, Anton Nuck, Professor at Leiden, rejected all transfusion devices that had existed before him and suggested the trachea of a young duck or hen, as it combines stiffness with elastic flexibility. He thought about transfusion very soberly, with regard to saving those who bleed to death he did justice to it, and it was also useful for the physiological verification of the circulatory system. Their use in severe internal diseases promises little benefit.

Matheus Gottfried Purmann, an excellent field doctor, reported in his writings from 1691-1699 on his transfusion attempts on animals and published his transfusions carried out with his friend Kaufmann, then those carried out by Johann Dolaeus. Purmann regretted most of all that the blood transfer was unable to break through in Germany due to the death of the most zealous defenders such as Major, Elsholz, and others.

Du Hamel said around 1700 that he had seen Bacculaureate Coga two years after he had been given the transfusion, that he was physically strong and healthy, but just as crazy as before the operation. Du Hamel does not seem to have known that Coga was only attempted for payment.

Johann Ludwig Hannemann, a restless, demolishing genius, confused and exaggerated in some directions, was a friend and defender of chiromancy, astrology, and alchemy. He is said to have made himself a Professor of Kiel through intrigue and was an enemy of Major. In his dissertation on "die Bewegung des Herzens" in 1706 he declared the doctrine of the blood circulation to be senseless and violently rejected transfusion and infusion.

In 1708, the lecturer in surgery and personal physician to the Dauphin P. Dionis in Paris, instructed his students from his chair that the Parliament had forbidden transfusion under severe penalties because it had committed many shameful things against charity and religion and because the authority wanted to set limits to this innovation. This gruesome operation died and was lost with its discoverers. In order to instil a salutary disgust for the transfusion in his listeners, he even resorted to lies and proclaimed that all those unfortunate people who were transfused in France had fallen into madness and rage and died as a result.

In his Dialogue, Amsterdam 1710, Barchusen mentions transfusion and judges it favourably because he inferred from the beneficial effect of the blood taken internally that transferred blood is useful.

Friedrich Germann, Physicist in Chemnitz, was particularly interested in Major and transfusion; he especially praised their effects after blood flows.

Claus Borichius, a famous professor of chemistry and botany in Copenhagen at the time, said in a dissertation "über das Blut" in 1715 that theologians should first and foremost decide whether the prohibition of the Mosaic laws against the use of blood also related to the therapeutic application of it.

Johann Junker, doctor in the orphanage, in his "Uebersicht der Chirurgie", Halle 1721, wants to recognize the beneficial effects of blood transfer only after severe

blood loss and Professor Fürstenau denies the possibility of rejuvenation through transfusion in his "Medicinischen Anforderungen", Leipzig 1727.

Peter Dion and Heister in "Lehrbuch der Chirurgie", Amsterdam 1739, both expressed very unfavourable views about this operation.

Due to its many opponents, transfusion was frowned upon and buried in France for a long time, de la Chapelle was the first to pull it back from oblivion in 1749; he believed that it had been wronged both by the authorities and by the doctors, and that after diligent experiments this operation could still achieve very important results for the maintenance of health and for the prolongation of human life.

In 1752 Brogiani described his compatriot Folli as the inventor of blood transfer and in 1757 Bich collected notes about this operation with extraordinary diligence.

Haller, the famous physiologist, took a very special interest in transfusion because of its importance for physiological experiments. He speaks very contemptuously of its therapeutic value; only after being a bite by poisonous animals does he ascribe some use to it. Amongst some strange things, Haller also relates that Denis injected horse blood into a young man without harming his health.

Bergmann made his way through his writings: "De injectionibus chirurgicis", Lips. 1757, and: "De chirurgia infusoria et aliis injectionibus" - noticeable.

In his "History of Health and the Art of Preserving It", Edinburgh 1760, James Mackenzie speaks favourably of transfusion and believes that it can prolong life.

The young scholar Hemman, who died far too early, was a warm supporter of transfusion, he regretted very much that it was rotting as a medical antiquity in the libraries and in 1791 said that it deserved resurrection and diligent use; only one should not again place hopes that cannot be fulfilled, such as the rejuvenation of human life, on them.

In the case of a false death, Fuller, London 1785, urgently advised, in addition to the utilization of electricity, the transfer of warm blood from the vein of an animal into the vein of a pseudo-dead man.

In the "Encyclopedia Universelle", Lassus, Professor of Surgery in Paris, judged the present operation in 1783 very unfavourably.

In his "Pathologie der Blutflüsse", Marburg 1785, Richter suggested transfusion against violent bleeding.

The animal experiments of Professor Michael Rosa, President of the Medical Faculty of Modena, the famous author of the "Phisiologischen Briefe", Naples 1788, are still very valuable material today. He gained considerable merit for the transfer of blood and on the basis of his experiments, came to the following conclusions: One can mix the blood of one animal with the blood of a second of a different species in its veins without bringing any disadvantage to life.

A considerably larger quantity of blood can be brought into the vessels of a healthy living animal than it originally contained without damage, so that the vascular system is only relatively full. The resuscitation of an animal that has bled to death and thereby become lifeless by the introduction of artery blood from a different kind of animal is perfectly possible and has been tried.

According to Historical Magazine, London in 1702, the surgeon Russell is said to have rescued a boy suffering from Hundswuth [rabies] by transfusion and In the same year Dr. Haarwood resuscitated a bleeding, seemingly dead dog by blood transfer in front of his audience at Cambridge College.

Professor Rougemont, too, in his "Handbuche der chirurgischen Operation", Frankfurt 1793, judges transfusion very favourably.

Darwin, the author of Zoonomia, London 1796, was a keen thinker and a farsighted doctor. In order to practice transfusion successfully, the blood must not be exposed to the air and must be artificially preserved in its natural temperature; the apparatus must be designed in such a way that the amount of blood can always be precisely determined. His instrument consisted of a fresh chicken intestine, 2½ [sic] centimetres long, with a tube the thickness of a swan's feather attached to one end

and a tube the thickness of a raven's feather attached to the other. After the man and the animal were connected by this instrument, and the intestine, the volume of which was known, was filled with blood, the latter was pressed into the blood vessel of the man. A vessel of 98 degrees Fahrenheit was held under the tube and the operation was carried out in a warm room, both to prevent the blood from cooling down. At the onset of a putrid fever, with a small pulse, and other signs which point to a lack of expansion, a repeated transfusion of about 140 grams per day, from a healthy person, from a donkey or sheep, will be of great use.

During the course of the disease, as long as the stomach is not functioning, the operation can be repeated every 2nd or 3rd day until this organ can take over the nutrition of the body again. Transfusion should also be used in cases of cancer of the pharynx and other mechanical nutritional barriers.

In his "Skizze einer Geschichte der Medicin", Konigsberg 1792, Hofrath Metzger names the healing attempts made with blood transfer as a telling example of the confusion of the human mind; this dangerous operation was only created only by the particular rawness of the idea.

The Danish Professor Tode, 1792, recommends transfusion in the event of major blood loss and cases of apparent death.

The "Medical Extract on the Nature of Health", London 1796, regrets that blood transfer was undeservedly forgotten and draws attention to the mighty Reitz, which the transferred artery blood exerts due to its richness in oxygen. The filling of the vessels is also of particular importance and according to the flow of blood it must be recommended as the most excellent aid.

In a dissertation on Jena in 1798, J. C. Haefner recommended the use of thick transfusion tubes, since the blood in them does not cool down as quickly; however, these should only be provided with small openings, so that the new and old blood mix only gradually. With conscientious care, animal blood cannot have a detrimental effect.

In 1798 the English doctor Willich had the firm conviction that one could prolong life by means of blood transfer.

The numerous experiments by Bichat in 1800 had only a physiological interest, and Portal also organized highly successful transfusion experiments at the same time in order to make the blood circulation clear to his students. We find descriptions of this in his "Curs der Experimental-Physiologie", Paris 1800. Portal attributes blood transfer only to a low level of effectiveness, because many diseases have no effect on the blood.

This is difficult operation to perform, the blood in the tubes often coagulates if you do not keep them warm, the binding of the tube into the animal's artery is usually associated with difficulties, and the animals easily bleed to death. You have to let out just as much blood as you add new blood, because otherwise very dangerous conditions and even death could follow. The transferred blood should have the same temperature as the blood of the recipient otherwise significant damage is likely to occur. There is also the danger that the diseases of animals would be transmitted with the animal blood.

In 1801 a pamphlet appeared in Hamburg: "Die Kunst, sich wieder zu verjüngen", in which old women are advised to have the transfusion carried out for the above purpose.

Inspired by Hufeland's work, Richter renewed the use of blood transfusion in blood flows in 1801. In any case, human blood is the most appropriate and it must be human arterial blood; Richter poses the question whether it would not be expedient for offenders to be forced by the authorities to provide part of their blood to save lives in the event of bleeding? All the more so because if the operation is carried out skilfully, there is no real danger to life associated with it. Hufeland deserves the credit for having drawn attention to transfusion, which was almost

forgotten in Germany, although this celebrated doctor expected something very beneficial from this operation as a means of resuscitation.

Kausch, an eccentric, came up against these views of Hufeland's for a peculiar reason: namely, in order to be able to introduce new blood, one would have to drain just as much old blood, and this procedure would usually kill someone with asphyxia.

Until the beginning of the nineteenth century, the majority of thinking physicians regarded transfusion as merely a surgical peculiarity. The German doctor, in Danish service, Paul Scheel travelled extensively for two years and searched, with the proverbial diligence of a German scholar, the libraries of Copenhagen, Vienna, Berlin, Dresden, Göttingen and Wolfenbüttel, as well as all the well-known book collections in Italy and France.

His work: "The transfusion of blood and injection of medicines into the veins", Copenhagen 1802–1803, shows the tireless sense of research, to which we owe the first solid overview of this exciting subject. It is to Scheel's credit that from then on the majority of physicians regarded transfusion as an operation worthy of special attention and further research.

Literature up to 1840

The "Hamburger Magazin" of 1811, Vol. I, p. 74, speaks very thoroughly and scientifically about the utilization of blood transfer in the case of significant bleeding.

In 1815 E. Hufeland again recommended blood transfer in "asphyxia"; also von Boer and von Graefe dealt with this subject in their own dissertations in 1817.

Further notes are given in 1817 by J. H. Leacock in the "Gaz. de santé", 1818 Clin, 1819 Hoefft, 1821 in the "Bibliothèque universelle de Genève", by Prevost and Dumas, who made a special contribution to the rebirth of the forgotten transfusion that had fallen into oblivion.

Magendi in the journal "Physiologie" in 1822, and Milne-Edwards in his "Thesen von Paris" in 1823, wrote about blood transfer.

In 1824 Schneider, Blundell and Tietzel, and in 1825 Doubleday and Waller published observations on transfusion.

In the "Medico-Chirurgical-Review in the Lancet" and in the "London Medical" of 1826 we find interesting comments from Blundell, Doubleday, and Jewell.

In the "Archiv de médecine", in "Hecker's Annalen", "The Lancet", in the "Edinburgh Medical and Surgical Journal", and in the "London Medical and Physical Journal" of 1828, Bourgeois Hertwig, Clement and Barton-Brown have some notifications concerning the subject.

In 1830 we found in the "Mémorial du Midi", vol. II, p. 35, 92, in the "American Journal of med. Sciences", in the "Journal universel", in the "Archiv. gen. de méd." vol. 22, p. 99, also in the "Journal des Progrès" p. 236, from Gondin, in "Midland med. a, surg. Repository". Febr. von Bird, in the "Hamburger Zeitschrift f. d. ges. Medicin", by Oppenheim, Fricke and Marcinkowsky, notes on our subject.

From 1831: Kleinert, "Repert. du Journal", XII, p. 100 and Crosse, "Cases in Midwifery", then "Bulletin thérapeutique", v. 1.

1832: A dissertation by Walter [Waller], Erlangen; another by J. T. Ingleby, London and the "Württemberg. med. Correspondenz-Blatt" No. 22.

1833: "Gazette médicale" May issue; Richerand, "Traité de Physiologie", vol. I, p. 459; "Archives générales", V. III, and "London Med. and Surg. Journal", June.

1834: "Schmidt's Jahrbuch", p. 292; "Guys Hospital Reports", V. II, p. 256; Bickersteth, "Liverpool med. Journal; Würtemb. med. Correspondenz", sheet no. 16; then "Medical Gazette", V. XIV.

- 1835: "Rusts Magzin", p. 437; "The Lancet" of March 28; Furner, "London Med. Gazette", July 4; Collins, "A practical treatise on Midwifery", London; finally Bischoff in "Müller's Archive", pp. 347 and 360.
- 1837: A dissertation by von Liphard: "On the transfusion of blood and infusion of medicaments into the blood vessels", Berlin.
- 1838: Berg, "würtemb. med. Correspondenzblatt", No. 1; Bischoff, "Müller's Archive", p. 351.
- 1839: Bliedung, "Pfaff's Mittheilungen", p. 45; Burdach, "Traité de Physiologie", p. 400; J. Blundell's lectures on obstetrics.

During the specified time periods, all transfusions were made with whole human or animal blood only, and the results, as we can see from the data available about them, cannot be described as unfavourable. Because of the new direction of physiology which had arisen around this period, which was also followed by surgery, there was a remarkable change in the ideas which we shall now consider.

2. TRANSFUSION WITH DEFIBRINATED BLOOD

A central sun according to which everything gravitated and which worked far back in all directions, Johannes Muller was first a professor in Bonn, then in Berlin, born in Coblenz in 1801, died in Berlin in 1858. At the time of his first training, the impact of the German natural philosophy of that time was still very considerable on him; Müller's high imagination was drawn to the same spiritually. But soon his keen sense pushed him to reality and he only trusted this and that which can be proven by the anatomist's knife. The mind and heart of the student who attended Bonn were open to science and to the varied spiritual stimuli of life. In Berlin, where he initially stayed to take the state exams, Rudolphi, the great anatomist and physiologist, exerted a powerful influence on him, which fuelled his already predominant inclination towards the aforementioned sciences. Nevertheless, Muller continued his philosophical studies and was an ardent follower of Hegel, which distanced him even more from Schelling's philosophy of nature. In 1824 he qualified as a professor in Bonn and gave lectures on comparative anatomy, physiology and general pathology; two years later he became an associate professor, but excessive efforts and studies, especially his self-observations on subjective vision, depressed him and shattered his nervous system. But soon he recovered and his spirit rose to high flight with new wings. The earlier fantastic tendency took a back seat and mathematical cold measure shone out, whereby his great research gained in level-headed clarity and strict method.

In 1830 Muller became a full professor of physiology in Bonn and in 1832 in Berlin. Seamlessly he went from fact to experience, and established natural phenomena through experiment, as well as what happened through criticism. He wrote down his great achievements in his handbooks of human physiology, in his Archive for Anatomy, Physiology and Scientific Medicine, Coblenz 1833-1840 and so on. He made immortal contributions to all parts of physiology and its related subjects, using with rare virtuosity everything that the advances in anatomy, physics, chemistry, experimental art, microscopy, and analytical methods in general could offer. His physiology of the nervous system is one of the most successful and surprising achievements in this field. It would lead us far too far to go into the sublime details of his achievements and in this regard I allow myself to refer to the classic commemorative speech by Rudolf Virchow about Johannes Muller, Berlin 1858, and especially to Bischoff's memorial speech at the Munich Academy and to the obituary by Emil Harless in the medical journal "Intelligence", No. 19, 1859.

Johannes Muller first expressed in his Manual of Physiology the idea that only the red blood cells are the carriers of the oxygen, the actually invigorating principle, and that the fibrin is thus superfluous for the transfusion.

"In addition, it will be of the utmost importance for the important operation of transfusion to use the beaten blood, which has been freed from its fibrous material, instead of the unbeaten blood".

Müller's authority ensured that from then on all attempts at transfusion with animals were carried out with beaten blood, if only for the sake of convenience. It was also argued that foreign blood is poisonous, therefore only human blood should be used in humans.

In the "Transfusion of Blood", Berlin 1828, Dieffenbach emphasized the superfluosity of fibrin in the blood transfer, and based on these two authorities, almost all transfusions from then on were made with defibrinated blood.

J. F. Dieffenbach, Professor of Surgery in Berlin, born in 1785, died in 1847, brought plastic surgery to a high level, first practicing myotomy and tenotomy and bringing them to particular prominence. He recorded his experiments and views on transfusion in the "Hamburger Zeitschrift" and "Rust's Magazin" in 1830, in "Rust's Chirurgie", B. IX, p. 633, and in his own dissertation. The numerous experiments and the clear judgment of the celebrated surgeon were very instructive and stimulating.

The change in blood does is not as rapid as some imagine. Dog blood loses in two hours at 37-40°C., 0.36 oxygen and absorbs 2.19 carbonic acid, after four hours 0.71 oxygen disappeared and 3.01 carbonic acid was absorbed; at freezing temperature this happens much slower. Panum twice injected defibrinated blood into a dog at different times, which he kept on ice for 24 hours, without causing any harm to the dog.

Grafe, Dieffenbach and Tietzel have earned the greatest merit in Germany through the resumption of transfusion trials.

Let us compare defibrinated and whole blood:

The defibrinated blood, in which a large part of the corpuscles are lost by beating, is considerably poorer in the latter than whole blood. Whole blood contains, 79 percent water, 13 percent haematin, globulin, and fibre, then 8 percent protein and solid components. Defibrinated blood contains 7% haematin and globulin, 9% protein and fixa [*sic*], then 84% water.

According to the substance, we have to distinguish between human and animal blood transfusions, as well as arterial, where arterial or venous blood vessel blood is used.

We refer to indirect transfusions as being those where the donor's blood is first defibrinated and then introduced, direct or immediate transfusion, where the donor's blood is transferred directly into the blood recipient's vessels. According to the source, we have to distinguish between venous-venous, venous-arterial, arterial-venous and arterial-arterial blood transfusions. Many and different instruments have been created for all these methods.

The most important and thorough work on this subject we owe to Panum, who sought to establish scientifically to justify that only defibrinated human blood is the most advantageous to use for transfusions in humans. His experiences and ideas were diametrically opposed to those of Martin, who in his work on "Transfusion bei Blutungen Neuentbundener", Berlin 1859, wanted to allow only un-defibrinated or whole blood to be used.

The transfusion is only intended to remedy the lack of functional red blood cells, and experiments have shown that blood cells of the same kind can be transferred in such a way that they continue to function normally, always taking in oxygen from the lungs and always releasing it into the tissues.

There is absolutely no doubt that defibrination is of great importance in the case of indirect blood transfers. Martin fought for the use of non-defibrinated blood, but he had too many opponents, the physiologists, especially Prevost and Bischoff, wanted to avoid embolism and thrombosis, although pathological autopsy never found a case after transfusion. Panum says that in a transfusion with unbeaten blood one can never be absolutely certain that one is not injecting partially coagulated blood, even if

small amounts of blood are being transferred. But the greater the amount of blood to be transferred, the greater the difficulty of execution and the greater the danger. Leisrink thinks that the blood becomes oxidized by beating and calls all experiments to prevent the coagulation of the blood, such as the addition of alkalis, according to Neudorfer, useless gimmicks. Whoever wants to defibrinate can use a simple wooden stick for this purpose, beat and whisk the blood with it for a few minutes, then filter it through a clean cloth, beat it again as a precaution until no fibrin remains on the stick, and then strain it again. The vessel that holds the sap of life should be placed in another vessel heated to 38° with warm water.

By 1824 James Blundell had already gathered around him a notable number of students who became zealous apostles of blood conduction in man, the better known among them: Hewitt, Brigham, Fox, May, Waller and Ashwell.

This subject was greatly enhanced by the experiments of Prevost and Dumas with defibrinated blood.

Martin, Demme, Nussbaum, Kuhne, Landois and Eulenburg endeavoured to bring clarity to the doctrine of blood conduction in relation to its practical implementation, especially in relation to displays.

In 1875 Panum sought to justify his already known views through experiments and expressed them in: "On orientation in the transfusion question". According to him, defibrinated blood behaves in exactly the same way as the originally non-defibrinated blood with regard to the respiratory functions. By shaking the blood is oxidized and freed from the excess of carbonic acid. No difference can be demonstrated between whisked blood, which was prepared from arterial blood and venous blood which was prepared from blood of the right heart, as well as that obtained from other blood vessels. Hence every type of defibrinated blood can be regarded as being of equal value for the accomplishment of the respiratory functions. Panum maintains that the transfer of defibrinated blood, with regard to its safe and easy execution, deserves to be preferred to any venous or arterial transfusion with non-defibrinated blood.

He also found that a dog that had been killed by bleeding could safely be called back to life by transferring defibrinated dog blood if one did not wait too long beyond the time when the reflex movements of the eyelids had ceased. After the reflex movements have ceased, a bleed animal can only be saved by transfusion. Even if greater quantities of defibrinated blood are injected than has ever been used in man, the vegetative functions are not altered by it. Magendie's views on fibrin, as well as those on the vital importance of fibrin dissolved in blood, were harshly opposed. The defibrinated blood of another individual of the same species is perfectly capable of performing those services which one expects from the transfusion, and the blood cells of the defibrinated blood function in the foreign organism exactly like those of the original blood, that is, it is a transplant possible. Panum has the firm conviction that the blood transfer in humans should only be carried out with human blood and warns against lamb and calf blood; it is certain to him that animal blood is not able to fulfil that function which, in his opinion, is the only sensible one, namely to remedy the lack of functional red blood cells in a way that can undoubtedly be aimed at by the passage of defibrinated human blood. The use of blood transfer should only be limited to those cases where a lack of functional red blood cells, which has been proven by a detailed examination, forms the basic character of the condition and where this deficiency can be remedied by timely transplantation of red blood cells of a strong, healthy person. The transfusion of defibrinated blood should not be postponed until the last hour because of excessive anxiety, as is usually the case.

The methods followed for transfusion were very different. The optimists, who raved about the transfer of the defibrinated juice, laid the matter very simply. A person who gave himself up to it was veined [*sic*], and the blood collected in a clean, warmed vessel and defibrinated. In the person to be operated on, an easily traceable blood vein, mostly the basilica or saphena, was exposed with a skin

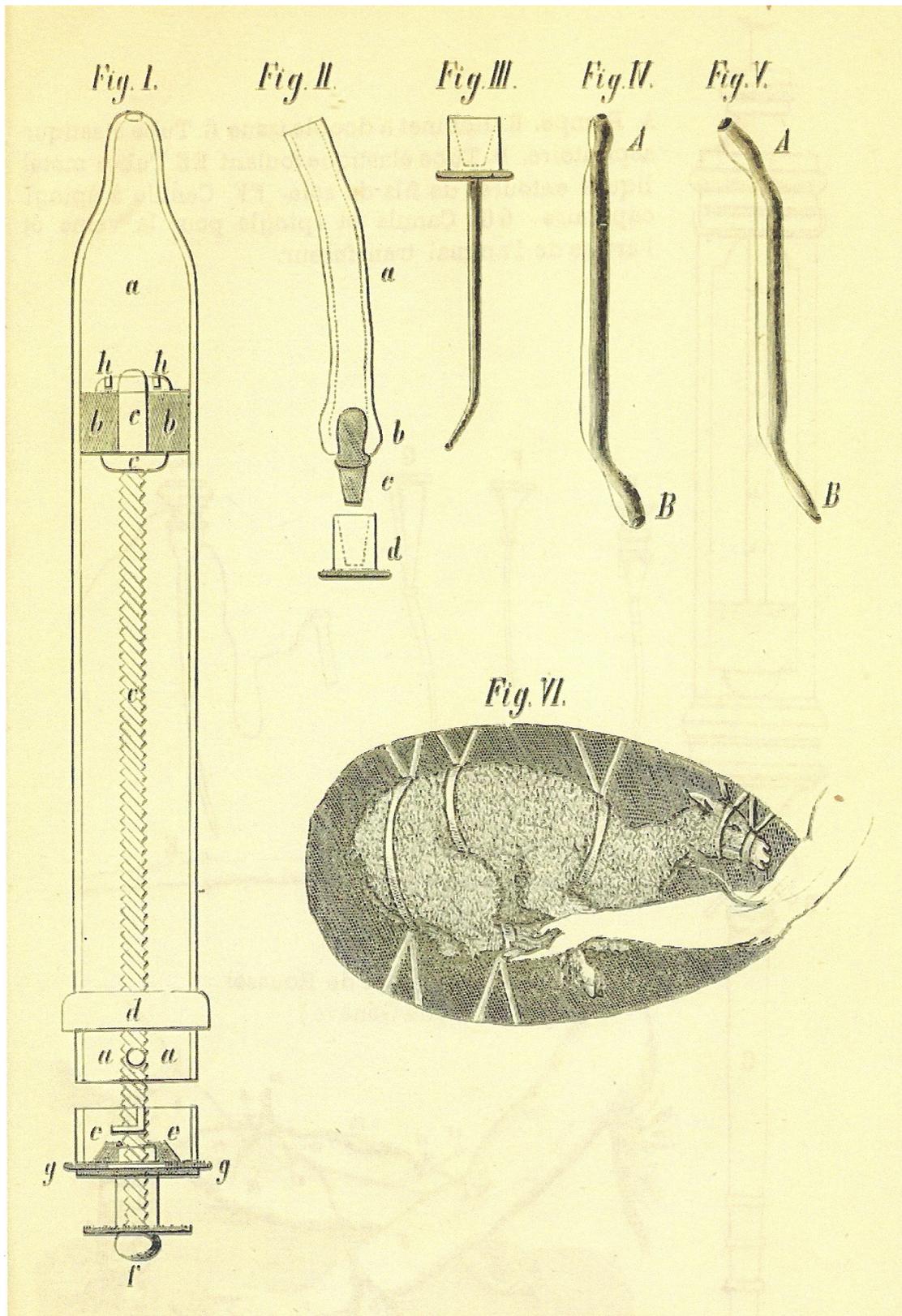
incision, freely dissected, tied downwards so that blood would not come from here into the operating field and a thread was also placed a little further up, but not tightened. Then the Eulenburg or Uterhart syringe, both of which were provided with air catchers, was filled, a cannula was also filled and the latter was inserted through an incision opening in the blood vein. The syringe was brought to the cannula, and the blood was driven into the vein with slow rotating movements of the plunger. Attention was drawn to observing the pulse of the non-chloroformed patient and to any disturbing as well as threatening phenomena. As simple and harmless as this method seems, it also has its dangers.

Of the many syringes for indirect transfusion, Mosler's and Martin's deserve to be mentioned. Hasse has modified it and had the following, highly practical injection syringe constructed:

In the glass syringe *a*, Fig. I, it is the rubber piston *b*, which rests on the piston rod *c* that moves. This rubber piston can be pressed together by the screw nut *h* against the plate *c* of the piston so that it fits exactly into the glass tube. The entire length of the piston rod *c* shows a left-hand double thread on its surface, four turns per centimetre and is rotated by the nut *f*. The sleeve *d* is attached to the glass tube *a*. The capsule *e* fits exactly onto the base of this sleeve *d* and is held on to it by double bayonet fasteners. The nut *f* is attached to the capsule *e* by means of the washer *g* in such a way that a screwed-in groove provides guidance and rotation. Fig. I is drawn in half size. A rubber hose *a*, Fig. II, is slipped over the rounded tip of the glass syringe, the free end of which receives the rounded part *b* of the intermediate piece *b c*. When the apparatus is filled with defibrinated blood, it is closed with the little silver cap *d*. This fits exactly onto the somewhat pointed part *c* of the intermediate piece *b c*. This also includes a silver cannula, Fig. III, the end of which is bent over at a length of 1 to 1½ centimetres at an obtuse angle. This bent part is inserted into the blood vessel, while the other part can be easily held. The use of this apparatus, which is certainly very useful, follows from what has been said.

If one has to do with less reliable syringes, the plunger *b* can be covered with a condom made of fish bladder, which was previously made wet, whereby smooth and completely clean walls are obtained. In this way it would be possible to do an indirect transfusion at any location with a normal syringe, then with a cannula, rubber tube, adapter, capsule and condom, all of which can easily be put in a first aid kit. Then I allow myself to remark that in an emergency, as with the transfusion I carried out, an ordinary syringe with a fine pointed tube is also perfectly sufficient.

Although it is very cautious and commendable to accomplish the transfusion with such complicated apparatus as we had the opportunity to see at the Vienna World's Fair in 1873, on the other hand a considerable number of transfusions are recorded in the annals of surgery, which are carried out with the simplest means and yet with the best results. In 1873, Heusner of Barnem successfully performed a transfusion with an irrigator and proved that the siphon effect alone was enough to pull the blood through the vein. Shortly afterwards, according to Wolfs, in the Citizens Hospital in Cologne, a very interesting blood transfer was made in a chronically anaemic individual. The blood was defibrinated, filtered, placed in a calibrated warmed vessel, then a rubber tube, 158 centimetres long, 4 millimetres in diameter, was led to the bottom of the vessel and held firmly. By sucking on one end of the rubber tube provided with a cannula, the same was evacuated and filled with blood. The tube was compressed on the cannula with two fingers, and the latter was inserted into the exposed left basic vein. The compression was stopped, the vessel raised 95 centimetres above the patient, and 100 grams of blood passed over without the slightest disturbance. With renewed compression of the rubber tube, the cannula was removed and the operation completed. The transfusion proceeded in and of itself, even if it was unsuccessful *quo ad vitam*, which probably means the healing effect in the most undisturbed way. Wolfs thinks that if the surgeon is careful, it is impossible for air to enter the vein.



The page of Figures at the end of the book (no page number) that is referred to in Chapter 2 – see above (as well as in Chapter 16)

To the literature of this epoch (Pages 59-63)

By ignoring the works and sources already cited in the text, we would like to draw your attention to the following:

- 1840: "The Lancet", September and October issue. Richard Oliver: "Edinburgh Medical and Surgical Journal", No. 145. "Hufelands Journal", p. 122.
- 1841: Giacomini in his "Trattato filosofico-sperimentale", Vol. V., part 2, portrayed blood transfer as "useless and dangerous, which even in the most favourable case is merely harmless". In Froriep's Notes, Vol. 18, p. 316 we find a description of S. Lane's transfusion apparatus. M. Peeth: "The Lancet", Nov. p. 305.
- 1842: "Wochenschrift von Casper", No. 20; "Zeitschrift für Naturskunde", Vol. 14, p. 141. Magendie: "Leçon sur les phénomènes physique de la vie", Vol. IV, pp. 366, 376, 387. "Vermischte Abhandlungen" by Wolf, Petersburg, p. 190. "Omodei Annali universali", Mugna, p. 569.
- 1843: "Jahrbuch des ärztlichen Vereines", Munich, p. 381.
- 1844: Carré: "Thèse de Paris".
- 1845: "Northern Journal of Medicine", December.
- 1847: "Gazette médicale de Paris", Sotteau, p. 787.
- 1849: "Comptes-rendus de la Soc. de Biol", Vol. 1, p. 105; Vol. 2 of 1850, p. 271; Vol. 3, p. 101 of 1851. Routh: Remarks on transfusion of blood, in "Medical Times", for August. "Transactions medico-surgical", Vol. 35, p. 422.
- 1850: "Gazette des hôpitaux", p. 150.
- 1851: "Oppenheim's Zeitschrift", Vol. 39, p. 436. Canstatt, Annual Report, Vol. 5, p. 153. Bernard: "Traité de Physiologie", Vol. 3, p. 649. Giovanni Polli: "Gazette d'Omodei". Périer Achille: "Thèse de Paris". "Archives generales". Vol. 25, "The Lancet", 19th April. "Bulletin thérapeutique", 15th May. "Revue medical", Mars. "Gazette des hôpitaux and medical de Paris", 15th July.
- 1852: Soden: "Medico-surgical Transactions", London Vol. 35, pp. 413, 434. Etienne Passemont: "Thèse de Paris". Desgranges and Devay: "Gazette medical de Paris", pp. 4, 20, 31. "Medical Times", New-York, p. 355.
- 1853: "Northern Lancet", p. 342. "The Lancet", 26th February. Mathieu: "Gazette des Hôpitaux", No. 119.
- 1854: Soden: "Révue thérapeutique", April issue. "Schmidt's Jahrbucher", Vol. 84, p. 217. Giovanni Polli: "Archives générales", October and November, then in "Annali universali di medicina", March. Filippo Trenti: "Del metodo operativo per praticare la transfusione del sanque", Pavia Durand: "Thèse de Montpellier".
- 1856: Leroux: "Thèse de Paris".
- 1857: "Gazette des hôpitaux", pp. 20, 65. "Moniteur des hôpitaux", p. 65. "Archives générales", p. 346. "Liverpool medico chirurgical Journal", from 1st January to 15th December. Edwards Milne: "Leçons sur la Physiologie", Vol. 1, p. 326. Girand Teulon: "Gazette medical de Paris", p. 215. Ebendaself: "Wheatkroft", from 26th December.
- 1858: E. Brown-Sequard: "Journal of Physiology" from 1855, Vol. 1, p. 729-735; from 1858, Vol. 1, pp. 175, 366, 666, 669, 731; from 1859, Vol. 2, p. 76. Quinche: "Thèse de Paris". "Union médicale", 5th February and 25th March. "Bulletin thérapeutique", p. 85. Farral: "Dublin Quarterly Journal", p. 150.
- 1860: Hastreiter: "Ueber die Transfusion des Blutes", J. Dissertation; Munich. Ignatz Neudörfer: Ueber die Transfusion bei Anemischen, in "Osterr". Zeitschrift für praktische Heilkunde", pp. 8, 9. Michaux: "Bulletin thérapeutique", Vol. 57, p. 163. Ch. Waller: On transfusion of blood, in "Obstetrical Transact. of London", Vol. 1.
- 1861: Martin: "Monatschrift für Geburtshife", April, p. 269.

- 1862: Demme: "Schweizer Zeitschrift für Heilkunde", p. 437. Nussbaum: "Baierischen Ärztliche Intellektivblatt", No. 9. Moncoqu de Caen: "Gazette des hôpitaux", p. 390. Brown-Sequard: "Journal de Physiology", Vol. 5, pp. 600, 653, 662.
- 1863: Hermann Demme: "Militär-chirurg. Studien", Würzburg, p. 178. Blasius: Statistik der transfusionen, in "Deutsche Klinik", No. 11. Braun: "Wiener medicinische Wochenschrift", No. 21. "Union médicale" No. 49. "Gazette médicale", Lyon, April. "Bulletin thérapeutique", No. 32. "The Lancet", 6th March. "Schmidt's Jahrbücher", p. 194. Courtois: "These de Strassbourg". P.L. Panum: "Experimentelle Untersuchungen über die Transfusion", Berlin. Wilhelm Boldt: "De transfusione", Berlin. Liegard: Reflexions, etc., in "Gazette de hôpitaux", p. 130. Oré: "Etudes historiques et physiologiques", Bordeaux.
- 1864: Moncoque e Morély: "Thèse de Paris". Kühne: "Centralblatt für die Medicinischen Wissenschaften", No. 9.
- 1865: Graily-Hewit: "Apparatus of transfusion in obstetrical transaction", London, Vol. VI., p. 126. Aveling: p. 136. Ssutugin: "Die Transfusion des Blutes", Petersburg. Giovanni Capello: "Annuario universale", from June. Braune: "Archiv für klinische Chirurgie", p. 648. Oré: "Recherches experimentales", Bordeaux.
- 1866: Mosler: Transfusion of leukaemia, in "Berliner Klinische Wochenschrift", No. 19. Eulenburg & Landois: "Die Transfusion des Blutes", Berlin. Friedberg: "Die Vergiftung durch Kohlendunst", Berlin, p. 161. Mayer: "Bairischen ärztlichen Intelligenzblatt" No. 37. Nussbaum: "Vier chirurgische Briefe", Munich. Braune: "Monatschrift für Geburtskunden", Leipzig, p. 215. Goulard: "De la transfusion du sang", Paris. Mathieu: "Gazette des hôpitaux", November. Polli: "Annuario universale", November, p. 237. Scalzi: Esperienze sulla transfusione, in "Giornale medico", Roma, April.
- 1867: Hirschfelder, Riehl, Kohlmann & Benhardi: Dissertations. "De transfusione sanguinis", Berolini. Schiltz: "Deutschen Klinik", No. 39. Frese: "Virchow's Archiv", p. 302. Landois: "Wiener medicinischen Wochenschrift", Nos. 30-59. Druit: "Chirurgisches Vademecum", Erlangen. Mosler: "Ueber Transfusion mit defibrinirtem Blute bei Leukämie und Anämie", Berlin. Kremer: "Ueber die Mittel zur Wiederbelebung", Greifswald. Roussel: "Archive de l'anatomie et de la physiologie", No. 5, p. 552-560. Uterhart: "Deutschen Klinik", p. 130. Benneke: "Berliner klinischen Wochenschrift", No. 14. Beck: "Kriegs-chirurgische Erfahrungen", Freiburg, p. 122. "Berichte der Gesellschaft der Wissenschaften", Leipzig: I, II, p. 49-52.
- 1868: Gesellius: "Capillarblut zur Transfusion" etc., Petersburg. Landois: Zur Statistik, in "Wiener medicin. Wochenschrift" No. 105. Mader: "Wr. med. Wochenschr", Nos. 50-57; then in "Wochenblatt der Gesellschaft der Wiener Dozte", No. 46. Tschörtner: "Metrorrhagien in Folge Lostrennungen". Diss., Berlin. Demme: "Mittheilungen im Lehrbuch für Kinderheilkunde" No. 1. Lange: A Case of Transfusion, in "Prager Viertel-Jahresschrift", IV. p. 168. Zaunschirn: Transfusion in a case of profound anaemia, in "Wiener medizinischen Presse" No. 36. Uterhart: "Eine vereinfachte Transfusionsspritze", Berlin. "Klinische Wochenschrift" No. 10. Braman: "Boston medic. and surg. Journ.", No. 26. Gentilhomme: "Bull. de la soc. Méd de Reims e Gezette hebdom", VIII. p. 620. Roussel: Instrument pour la transfusion du sang, in "l'Arch. de l'Anat. et de la physiologie" p. 552-559. Willis: in "Gazette des hôpitaux", p. 586. Buchser: "Successful case of transfusion" in "New York Med. Record", 1st Oct., p. 338.

To the literature of this epoch (Pages 141-144)

- 1869: Hüter in "Centralblatt", No. 25. C. Hennig: "Monatsschrift für Geburtskunde", Vol. 33, p. 223. Dutescu: "Dissertation", Greifswald. Rautenberg: Zwei Fälle von Transfusion undefibrinirten Blutes, in "Monatsschrift für Geburtskunde", p. 116. Bresgen: Die Lanzennadel spritze zur in-und Transfusion, in "Berliner Klinische Wochenschrift", No. 30. Mittler: "Versuche über die Transfusion des Blutes", Vienna. Stöhr: "Archiv für klinische Medicin", Vol. 8, Issue 5-6. Casselmann: Zur Geschichte der Transfusion, in "Pharmaceutische Zeitschrift für Russland", Vol. 8, Issue 2. Belina-Swiontkowsky: "Die Transfusion des Blutes", Heidelberg. Herzberg: "Dissertation", Greifswald. Hasse: "Berliner klinischen Wochenschrift", No. 35. "Concato nella Rivista clinica di Settembre". Albanese: "Sette casi di transfusione", Palermo. Brown-Sequard: "Gazette de Paris", no. 32. De Belina: Nouveau procédé, in "Compte-rendu", No. 14, p. 765. Marmonier: "De la transfusione du sang", Paris. "Lorain dans la Gazette medicale de Paris", No. 32, p. 427. Braxton-Hicks: Cases of transfusion, etc., in "Guy's Hosp. Repts", Vol. 14, pp. 1-15. MacEwen: "Glasgow Medical Journ.", November, p. 128. Buchser: Successful case of transfusion, in "New York Medical Record", October, p. 337. Lister: Case of transfusion, in "Glasgow medical journ.", November. Sternberg: Transfusion of blood and other liquids, in "New York med. record", October.
- 1870: Hüter: The arterial transfusion, in "Archiv für klinische Chirurgie", Vol. 12, p. 1; A case of carbon oxide poisoning cured by transfusion, in the "Berliner klinischen Wochenschrift", No. 28, p. 341. Evers: "Zur Casuistik der Transfusion", in Nos. 8, 9, 10 of "Deutsche Klinik". Uterhart: Zur Lehre von der Transfusion, in "Berliner klinischen Wochenschrift", No. 4. Schatz: "Monatsschrift für Geburtskunde", p. 95. Michel: Transfusion mit Erfolg, in "Berliner Wochenschrift". Massmann: "Beiträge zur Casuistik der Transfusion des Blutes", Berlin. Bresgen: "Die Lanzen-Nadelspritze zur Infusion und Transfusion beim Scheintod und in der Laryngoskopie", Leipzig and Cologne. De Belina: Note sur deux cas où la transfusion a été pratiquée avec succes, in "Gazette medicale de Paris", No. 2. Lemattre: La transfusion du sang, in "Revue des deux Mondes". January, p. 387. Saklén: "Dissertation om transfusion", Helsingfors. Cavaleri: "Annali universale", p. 508. Albanese: Sette casi di transfusione, in "Annali universali", pp. 125, 125. Inversione chronica, etc., in "Gazette clinica dello spedale civico di Palermo", Nos. 10 and 11. Freer: Report of a vivisection, in "Boston, Med. and. surg. Journal", Jan. p. 26. Donnel: Remarks on the operation of transfusion, etc., in "Dublin quarterly journal of med. science", November, p. 257. Thomas Beatty: Transfusion successful in a case, etc., in "Dublin Quarterly Journal," May.
- 1871: Jürgensen: Vier Fälle von Transfusion, in Nos. 21, 22, 25, 26, in "Berliner klinischen Wochenschrift". Gusserow: Ueber hochgradigste Anämie Schwangerer, in "Archiv für Gynäkologie", Vol. 2, p. 234. Bahrdt: Nitrobenzinvergiftung, in "Archiv für Heilkunde", Vol. 12, p. 320. Leisrink: Vier Fälle von Transfusion, in "Berliner klinischen Wochenschrift", No. 7. Wilke: Ein Fall von Pyämie, geheilt durch arterielle Transfusion, in "Berliner klinischen Wochenschrift", March 25. Betz: "Memorabilien", Heilbronn. Asché: Neuere Mittheilungen über die Transfusion des Blutes, in "Schmidt's Jahrbüchern". De Belina: Transfusion du sang defibriné, in "Gazette med. de Paris ", p. 46. Richardson: Meeting of the Medical Society of London, in "Med. Times and Gaz.", p. 264. Ruggi: Nuova cannula per la transfusione, in "Rivista clinica di Bologna", p. 223. De Christoforis: "La transfusione del sangue et le infusioni", Milano. Buscher: A successful case of transfusion, in "New York Med. Record", p. 100. Sacklén: "Nord. Med. Ark." III. p. 1.

- 1872: Kernig: Zwei fälle von transfusionen im cholera typhoid, in "Petersburger medicinischen Zeitschrift", September. Wilke: Ein Fall von Pyämie, geheilt durch arterielle transfusion, in "Berliner klinischen Wochenschrift", 25th March. Leisrink: Vier fälle von transfusion, in "Berliner medicinischen Wochenschrift", No. 7. Rommelär: Die behandlung der phosphor-vergiftung, in "Bull. de Thér", Brussels, 29th Feb., p. 145. Wickham Legg: "Treatise on Haemophilia", London.
- 1873: Gesellius: "Die Transfusion des Blutes", Petersburg and Leipzig. Busch: Ein fall von unterbindung mit darauffolgender transfusion, in "Archiv für klinische Chirurgie", Berlin, vol. 15, issue 2, p. 475. Wolfs: Der heber der einfachste und vollkommenste transfusions-apparat, in "Deutsche Zeitschrift für Chirurgie", vol. 2, issue 6, p. 552. Heyfelder: Besprechung der transfusion von Gesellius, in "Deutsche Zeitschrift für Chirurgie", Leipzig, vol. 2, issue 6, p. 572. Quinquand: About the behaviour of haemoglobin, in "The London med. Record", No. 36. Bauer: Zersetzungs Vorgänge nach Blutentziehungen, in "Zeitschrift für Biologie", Vol. 8, Issue 4. Nicolai and Tabure: Thierversuche, in "J. Dissertation", Petersburg.
- 1874: Gesellius: "Zur Thierblut-Transfusion beim Menschen", Petersburg and Leipzig. Hasse: "Die Lammblood-Transfusion beim Menschen", Petersburg and Leipzig. Steiner: : Ueber den stand der transfusions-frage, in "Med. Wochenschrift", No. 14, and zwei thierblut-transfusionen, in "Med. Wochenschrift", No. 16. Bruberger: Ueber Transfusion und ihren Werth im Felde, in the October issue of the "Deutschen - militärärztlichen Zeitschrift". Heyfelder: "Kriegschirurgisches Vademecum", p. 215, Petersburg and Leipzig. Schliep: Fall von directer arterieller transfusion, in "Berliner Klinische Wochenschrift", 19th January. Heyfelder: Zur Lehre von der transfusion, in "Deutsche Zeitschrift für Chirurgie", Berlin, Vol. 4, Issue 4, p. 369; Issue 5 and 6, p. 496, then Vol. 5, issue 1, p. 108. Nicolas-Duranty: Versuche über transfusion des blutes, in "Gaz. hebdomadaire de med. et de chirg.", 27th February. Nagel and Tupper: Beitrag zur transfusion, in the "Berliner klinischen Wochenschrift". Collin: Versuche an thieren, in "Gaz. des hôp." No. 91. Béhier: Ein fall von Transfusion, in "Gaz. med. de Paris", 14th March. Beigl: Ueber die ersten transfusionen, in "Wiener med. Wochenschrift", No. 16; a case in No. 23. Hirschmann: Ueber die Fibrinbildung, in "Aerztl. Corresp.-Blatt für Böhmen", February. Injectionen von defibrinirtem Blute, in "Med. Wochenschrift", p. 747.
- 1875: Ponfick: Experimentelle beiträge zur lehre von der transfusion, in "Virchow's Archiv", vol. 62. Billroth: Zur Bluttransfusion, in Nos. 1, 2, 3, 4 of the "Wiener med. Wochenschrift". Bruberger: Zur transfusions-frage, in the April issue of "Deutschen militär-ärztlichen Zeitschrift". Lannelon: Injectionen von chloral in venen, in "Gaz. des hôpitaux", 27th October 1874 and 23rd March 1875. Heyfelder: Zur lehre von der transfusion, "Deutsche Zeitschrift für Chirurgie", Vol. 4, Issue 4-6. Panum: Zur orientirung in der transfusions - frage, in "Virchow's Archiv", Vol. 63, Issue 1-2.